

CONTRIBUTIONS TO THE ALPINE FLORA OF THE NORTHEASTERN UNITED STATES

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ABSTRACT

Alpine and sub-alpine cliff floras have changed since botanists first explored the mountaintops of the northeastern United States; results of recent extensive field surveys are compared with the historical database to document these changes. New distribution and population data are presented for 27 rare northern taxa in Vermont, New York, New Hampshire and Maine. *Paronychia argyrocoma* is reported for the first time from Vermont. Eleven historical records for rare species are dismissed as errors. Most newly reported rare plant locations appear to be previously unexplored areas and do not represent recent dispersal. Population declines are indicated for *Arenaria rubella* in Vermont and *Luzula spicata* in New York, although the populations are in remote and pristine sites. Local extirpations are presumed in Vermont for *Arnica lanceolata*, *Castilleja septentrionalis*, *Empetrum eamesii* ssp. *atropurpureum*, *Geocaulon lividum*, and *Solidago cutleri*, and in New York for *Cassiope hypnoides*.

Key Words: Alpine flora, endangered species, extirpation, Maine, New Hampshire, Vermont, New York

Over the last three decades, recreational use of mountaintops in the northeast has reached all-time highs (Waterman and Waterman, 1989). Widespread soil compaction and trail erosion threatens rare members of the alpine flora. Air pollution and climatic warming are also potential threats. As a result, many alpine species are on state lists of rare, threatened or endangered plants (Countryman, 1978; Thompson, 1989; Storks and Crow, 1978; Mitchell et al., 1980; Zika, 1990a; Dibble et al., 1989, 1990). Mountain species in these references are the subject of this investigation.

The study was initiated when *Draba cana* Rydb. and *Carex atratifomis* Britt. were re-located in Smugglers Notch, after a 100-year hiatus in their collecting record. Had other high-elevation species been overlooked by recent workers? Countryman (1978) suspected the "rare" grasses of Vermont were undercollected, and this suspicion was confirmed for many species (Zika, 1990b). In this paper, for alpine and subalpine species I compare

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some historical and contemporary data, provide evidence suggesting increases or declines in several taxa, reject eleven historical records, discuss one new state record, and record relevant population and ecological data for new stations and re-locations of some state rare, threatened or endangered species.

Distributions of most mountain species in the northeastern United States were well-known by the turn of the century (Pringle, 1876, 1897; Peck, 1899, 1900; Brainerd et al., 1900; Fernald, 1901, 1907; Kennedy, 1904; Pease, 1964). Collecting activity in alpine areas peaked between the 1870's and World War I, a period of intense professional and amateur collecting for herbaria. The results were thousands of pressed specimens and ample literature.

METHODS

Literature and herbarium searches provided a historical framework and a list of sites for intensive field surveys. Current population data were generated by repeatedly visiting classic collecting localities at Smugglers Notch (Lamoille Co., VT), Mt. Mansfield (Chittenden and Lamoille Cos., VT), Camels Hump (Chittenden and Washington Cos., VT), Mt. Pisgah (Orleans Co., VT), the Presidential Range including Mt. Washington (Coos Co., NH), and in New York's Essex Co.: Mt. Marcy, Panther Gorge, Indian Pass and Wallface Mountain. Other peaks were investigated, but less frequently. Field work was conducted between 1979 and 1990.

All species reported as locally extirpated in New York or Vermont were observed by the writer on Mt. Katahdin, Mt. Washington, or elsewhere, to learn the proper "search image," microsite requirements and associates.

RESULTS

Species are listed alphabetically; vernacular names follow Harris et al. (1964).

Agrostis mertensii

Vermont's fourth station for *Agrostis mertensii* Trin., boreal bentgrass, was recorded in 1989, on the ledgy schist summit of Mt. Hunger, Worcester, Washington Co., at 3490 feet (*Zika & Dann 10662 VT*). About 20 plants were growing in turf dominated

by *Deschampsia flexuosa* (L.) Trin., with *Carex brunnescens* (Pers.) Poir. ex Lam. The colony was limited to a few square meters, and no plant was found on the adjacent exposed summit of White Rocks Mountain.

Arenaria rubella

Arenaria rubella (Wahlenb.) Sm., marble-sandwort, is known from only two locations in the eastern United States. Historical data for the Vermont population, in Smugglers Notch, include a west-side 1894 collection (NEBC, VT) labeled "rare," and an 1894 collection (VT) from north-facing cliffs in another west-side ravine, labeled "in abundance." East-side collections end in 1932 (MASS). A plant was collected on the roadside in 1926 (MASS).

Arenaria rubella can no longer be described as common or abundant in Smugglers Notch; its distribution and abundance have declined. Only two ravines currently support the species. In the last decade the population was restricted to two habitats: steep gravelly slopes, and inaccessible shelves on the tall cliffs above. The population fluctuated from 5–50. When plants were scarce most seedling establishment was observed on steep unconsolidated substrates, in mats of *Saxifraga oppositifolia* L. Following landslides, populations increase with recruitment on newly exposed gravels.

The high slopes of Smugglers Notch landslides are seldom visited by humans and are protected as part of the Mt. Mansfield State Forest. Portions are closed during the *Falco peregrinus* nesting season.

Arnica lanceolata

Arnica lanceolata Nutt., hairy arnica, is a showy subalpine and alpine species. Schweinfurth and St. John (St. John, 1987) collected it once in Vermont, in 1911, on the northern spur of Mt. Mansfield above Smugglers Notch. It has not been seen again, despite repeated searches, and is presumed extirpated in Vermont. The forested historical locality is remote and undisturbed.

In New York *A. lanceolata* shows an interesting historical distribution along the northern of the two Indian Pass Brooks. It was collected in five sites between 1899 and 1989, along 2.5 km of the stream. The population appears to episodically colonize

anorthosite shores when conditions are favorable for seed dispersal and seedling establishment. Presumably seeds are dispersed by the brook, by wind or by animals traveling along the riparian corridor.

The low elevation colonies apparently did not persist. Peck (1899) could not re-locate his original streamside station. Repeated searches in 1988 and 1989 by Steve Clemants, Rose Paul and the writer determined that the uppermost colony was the only one extant. This location was a wet exposed NE-facing cliff above the brook, and may have been a stable *Arnica* habitat and hence a reliable seed source for the lower sites, which are all forested at present. *Arnica lanceolata* (Zika 10707 NYS) was associated with *Houstonia caerulea* L., *Thalictrum pubescens* Pursh, *Aster umbellatus* Mill., *Carex debilis* Michx., *Spiraea latifolia* (Ait.) Borkh., *Vaccinium uliginosum* L. and *Lycopodium selago* L.

One wonders what led to the loss of *Arnica* sites on Indian Pass Brook. Logging dams used 1913–1915 might have altered stream-bank habitats by changing the seasonality and volume of flow. *Arnica* requires openings; an important factor may have been declining light levels concomitant with shoreline forest regrowth following logging in 1913–1915. Beaver activity or siltation following logging are possible explanations; *Arnica* clones may be short-lived. Combinations of factors are possible as well.

Asplenium viride

The station of *Asplenium viride* Huds. credited to Camels Hump, Vermont “*legit* Pringle,” (Brainerd et al., 1900; Eggleston, 1905; Eggleston et al., 1915) must be discounted. Pringle apparently never collected the species there, nor mentioned it in his publications. Pringle was a fern enthusiast, eagerly collecting the unusual species he discovered in the 1870’s in Vermont (Anonymous, 1877; Davis, 1936). Surely he would have collected and published such a find from Camels Hump; he did so for his 1876 discovery of *Asplenium viride* at Smugglers Notch and Mt. Mansfield, as an addition to the United States flora (Pringle, 1876, 1897). There he collected considerable quantities for distribution. Pringle collected on Camels Hump only in the years 1874, 1875, and 1876 (Pringle, 1897), never returning “because its subalpine area is limited, and consequently the number of rare plants to be found there is small.” No *Asplenium* was found in the course of intensive field work on Camels Hump either by the writer or by

many others, including members of the American Fern Society in 1926 (Chisolm, 1926).

No Camels Hump voucher could be found at GH, HNH, MO, NEBC, NY, SJFM, TUFT, VINS or VT. There was no reference to a Washington Co. Pringle collection in either the manuscript notes for Harry Ahles' unpublished flora of New England, nor in the Vermont checklist (Atwood et al., 1973). Those works were based on the holdings of more than 30 public and private herbaria in the region. The *Asplenium viride* citation for Camels Hump is believed to be a confusion with Pringle's record of *Woodsia glabella* on Camels Hump (Pringle 1897; Chisholm, 1926; Zika, 1982), which was not mentioned by Brainerd et al. (1900), Eggleston (1905) or Eggleston et al. (1915).

Calamagrostis pickeringii

Greene (1987) did not credit Vermont with any records of Pickering's reedgrass. Although he verified the identification of an 1877 collection from Vermont (*Pringle s.n. US*), Greene's annotation suggested the sheet was a mislabeled collection from New Hampshire, since no other collections are known from Vermont. Pringle's specimen bears no locality data besides "Vermont." It is the basis of reports in Brainerd et al. (1900), Eggleston et al. (1915), Fernald (1907, 1950) and Hitchcock and Chase (1971).

I disagree with Greene's interpretation of Pringle's Vermont record, and accept the Vermont record, as did Pringle's contemporaries. Pringle was a careful collector and there is no indication that he mislabeled other rare species he found in Vermont, the vast majority of which were confirmed by later collectors. The distribution of *Calamagrostis pickeringii* Gray in northern New York and northern New Hampshire suggests it should also be in Vermont's mountains. Its habitats and associated flora in New York (Zika and Jenkins, unpubl. data) suggest Vermont's station could have been a boggy sphagnum area on the ridgeline of Mt. Mansfield. Pringle collected heavily there in 1877.

Scrutiny of the damp mossy habitats on Mt. Mansfield's ridgeline has shown that a number of rare species have disappeared this century, including *Geocaulon lividum* (Rich.) Fern., *Goodyera repens* (L.) R. Br., *Listera cordata* (L.) R. Br., and apparently *C. pickeringii*. All the historical collection sites, in or near bogs, have been degraded by human disturbance.

Carex atratiformis

The only historical station for *Carex atratiformis* Britt., blackish sedge, in Vermont was in Smugglers Notch, where it was last collected in 1879. This population was rediscovered in 1979 (Zika 1028 MASS, 1740 VT, 10892 VT), on both the east and west slopes of the notch, between 2200 and 3400 feet, growing with *Agrostis scabra* Willd., *Asplenium viride* Huds., *Carex leptalea* Wahl., *C. scirpoidea* Michx., *Conioselinum chinense* (L.) BSP., *Listera convallarioides* (Sw.) Nutt. ex Ell. and *Rubus pubescens* Raf.

Cassiope hypnoides

Moss plant, a circumboreal species, is at the southern limit of its range in northern New England and New York. Contrary to Mitchell (1986), Miller (1989) doubted that *Cassiope hypnoides* (L.) D. Don was ever a contemporary member of the New York flora. However, there are compelling arguments the species was present in the 1800's, suggesting it is now extirpated in New York. Two herbarium specimens (*Haberer 542* NYS, PA) and correspondence from the collector (NY State Museum botany files) are robust evidence the species was on Panther Mountain, town of Morehouse, Hamilton Co., in 1879. House (1924) confused the locality with a Panther Mountain in Essex Co., but Haberer wrote to House and emphasized *Cassiope* was in Hamilton Co.

Steve Clemants of the New York Natural Heritage Program could not find *Cassiope* in 1987 at Panther Mountain, Morehouse. As Miller (1989) pointed out, the habitat is apparently no longer suitable. The mountain is currently dominated by hemlock-hardwood forest, presumably established after logging eliminated a more boreal evergreen forest type in the 1800's. In New England *Cassiope* is an alpine snowbank species. Apparently a peripheral low-elevation habitat once existed on Panther Mountain. Partial shade from a pre-logging spruce-fir canopy may have sheltered accumulated winter snowdrifts and avalanches at the base of one of the small cliffs, forming a marginal ice cave talus community (Reschke, 1990, p. 51). *Cassiope* habitat could have been altered irreparably with logging, when the resulting second-growth was predominantly deciduous, and the crucial coniferous shade required to retard snowmelt was lost.

A second New York site for *Cassiope* was credited to C. C.

Parry in the 1840's (Peck 1891, 1900) from the summit of Mt. Marcy. Suitable habitat on Marcy's summit exists. Parry was a careful botanist who often worked in alpine areas (Britton, 1890; Parry, 1889–1897), so his report was not likely to be based on a misidentification of this unique member of the northeastern alpine flora. Miller (1989) and Adams et al. (1920) rejected the Mt. Marcy record because the voucher specimen could not be located. Certainly the missing collection creates some doubt, but fewer than 10% of the pre-1850 alpine vouchers from Vermont have survived to the present (Zika, unpubl. data); thus the Mt. Marcy *Cassiope* record cannot be summarily dismissed. Indeed, collections of the species at a lower elevation in Hamilton Co. suggest it potentially was in the High Peaks alpine zone in Essex Co. in the 1800's. Field work by Ketchledge (1984), DiNunzio (1972, unpubl. M. S. thesis, State U. of NY, Syracuse), the writer and others has failed to relocate *C. hypnoides* on Mt. Marcy. By 1880, upon failing to re-locate *Cassiope*, Peck (1891, 1900) suspected the species had already been extirpated on Mt. Marcy. I concur, and suggest the species has been extirpated in New York State.

The alpine community of Mt. Marcy was severely degraded this century by visiting hikers and campers, although the peak is currently a designated wilderness. Trampling may have affected the historical *Cassiope* location. Remote Panther Mt. remained undisturbed following logging.

Castilleja septentrionalis

Oakes (1842) reported the first Vermont collection of *Castilleja septentrionalis* Lindl. (as *Bartsia pallida* L.) by Tuckerman and Macrae in 1839, "on the north side of Mansfield Mountain, near the summit." It is not known whether this site was on the ridgetop alpine zone, or on the sub-alpine cliffs or streams in Smugglers Notch where the species is extant today, more than one-half mile northeast of (and 1500 feet below) the Mt. Mansfield ridgeline. No data are available from the label of the voucher collection; it has not been found, like most of Tuckerman's and Macrae's collections from this period. Support for an alpine rather than a sub-alpine station comes from Tuckerman's journal entries for 1839, at the Amherst College Archives. On 3 July, *Bartsia pallida* was seen on the "northeast side [of the] Chin," the summit of the alpine ridge. Further evidence is on page 88 of the same journal

for 1839. There is a list of plants found "by Edward Tuckerman junior in the alpine regions of high mountains in N. E." and it includes *Bartsia pallida* from "Mansfield mtn. Vt. 1839," and from the White Mountains in 1838.

Castilleja septentrionalis has not been found on the Chin of Mt. Mansfield since 1839. Recent intensive field searches by the writer and by Green Mountain Club rangers and caretakers (e.g., Bristow et al., 1977) indicate that pale painted cup has disappeared from this site, despite its current status as a protected natural area.

Draba cana

Draba cana Rydb. (*D. lanceolata* of northeastern authors, not Royle) was discovered in Smugglers Notch in 1878 (*Pringle s.n.* VT). Eggleston (1895) quoted Pringle's description of the population as, "a patch I could have covered with my hat." Eggleston (1895) "found a similar patch in 1893" and labeled his collections "very rare" (*Eggleston s.n.* HNH, NEBC, NY). A tiny station was documented in 1979 (*Zika 1051* MASS) at the base of an exposed xeric cliff on the west side of the notch, at 2700 feet, under a spineless *Rosa blanda* Ait., rather distant from the landslide gullies that are usually explored. The writer and David Barrington found another tiny colony in 1990 at 3000 feet, on a rotten north-facing cliff on the west side of Smugglers Notch (*Zika 10909* VT).

Draba cana is a locally common plant in Vermont only on the southwest face of Mt. Pisgah, where hundreds are extant. It was apparently first collected there in 1862 by Mann, Tuckerman, et al. (Kennedy, 1904; Fernald and Knowlton, 1905).

Empetrum eamesii ssp. atropurpureum

Empetrum eamesii ssp. *atropurpureum* (Fern. & Wieg.) D. Love, purple crowberry, was collected on Mt. Mansfield between 1851 (*Russell s.n.* A) and 1908 (*Flynn s.n.* NEBC, VT). It has not been seen more recently, despite intensive field searches by the author and many others, and is presumed extirpated in Vermont.

Empetrum nigrum

Black crowberry, *E. nigrum* L., was discovered at a fourth station in Vermont by Harry T. Peet, Jr., in 1982. About 20 plants were located on a large schist outcrop at 3250 feet, on the south

flank of Bolton Mountain, Bolton, Chittenden Co. (Zika, Peet & Sulek 6325 VT). It was growing with *Amelanchier bartramiana* (Tausch) Roem., *Betula papyrifera* Marsh. var. *cordifolia* (Regel) Fern., *Carex brunnescens* (Pers.) Poir. ex Lam., *C. debilis* Michx., *Cystopteris fragilis* (L.) Bernh., *Ledum groenlandicum* Oeder, *Nemopanthus mucronatus* (L.) Loesener, *Picea mariana* (Mill.) BSP., *Sorbus americana* Marsh., *Vaccinium boreale* Hall & Aalders, *V. myrtilloides* Michx., *V. uliginosum* L. and a collection tentatively identified as *V. boreale* × *uliginosum*.

Festuca brachyphylla

Festuca brachyphylla Schult. & Schult., alpine fescue, was not credited to Vermont or New York State by Frederiksen (1982) in his treatment of this arctic and western alpine species. Apparently reports of *F. saximontana* Rydb. from the northeastern United States can be referred to *F. brachyphylla*. Gleason and Cronquist (1963, p. 55) incorrectly state the habitat is "alpine summits of N. Y. and New England." *Festuca brachyphylla* is not found on summits or in alpine areas in the northeastern United States. The two historical stations in the region are Smugglers Notch and Wallface Mountain. Small extant populations were confirmed at both sites in 1990. These subalpine habitats are similar, being at ca. 3000 feet, on north-facing steep rocky turf, and partially shaded by tall cliffs. Associated species include *Campanula rotundifolia* L., *Carex scirpoidea* Michx., *Draba arabisans* Michx., *Houstonia caerulea* L. and *Saxifraga paniculata* Mill. The bluish foliage of alpine fescue helps distinguish it from similar capillary-leaved cespitose plants on the cliffs, such as sterile *Deschampsia flexuosa* (L.) Trin. and *Carex eburnea* Boott.

Some New York reports (Smith, 1965; Mitchell, 1986; Clements, 1989) are based on a 1964 collection from Whiteface Mountain, Wilmington, Essex Co. (Smith et al. 37420 NYS). The Whiteface specimen is *Festuca tenuifolia* Sibth.

Geocaulon lividum

Northern comandra is rare and threatened in New Hampshire (Pub. Law 93-205, Res-N 301.02), although Stern (1979) found it was widespread in the Mahoosuc Range on the Maine-New Hampshire border. Most *Geocaulon* populations in the northeast are quite small, and the distinctive rhizome is collected all too

often. *Geocaulon lividum* is a cryptic species, easily overlooked unless in fruit. In nature, *G. lividum* resembles a solitary unbranched shoot of *Comandra umbellata*, and is colored like *Vaccinium uliginosum* L., a common associate.

Geocaulon lividum was re-located in 1984 at Eggleston's 1901 station on Mt. Clinton in the Presidential Range, Bean Grant, Coos Co., N. H. (Pease, 1964). The solitary plant was observed on the edge of the Appalachian Trail at 4100 feet elev., in *Abies* scrub. To help protect the population, no voucher was collected.

In Vermont, northern comandra was known from a single site, a tiny bog on Mt. Mansfield, where it has not been found since 1901, despite intensive field searches, and is now presumed extirpated. The bogs on Mt. Mansfield have been degraded by human disturbance despite the current protected status of the alpine ridge.

Geum peckii

Only one report from Vermont was found for *Geum peckii* Pursh, mountain avens (Atwood et al., 1973). The citation was based on a collection (*Carpenter s.n.* VT) labelled: "Mt. Willoughby slope, 21 July 1926." Mt. Pisgah, on the shore of Lake Willoughby, Westmore, Orleans Co., Vermont, was often called Mt. Willoughby by collectors. There is evidence Carpenter was careless with his label data, and his Vermont record is rejected for several reasons.

No recent workers have found this endemic of New Hampshire and Nova Scotia in the Lake Willoughby area. Furthermore, Carpenter (1927) did not include the species in his article on recent additions to the Vermont flora. The date of collection also suggests a locality error. On 20 July 1926, Carpenter was collecting *Scirpus cespitosus* L. "near [the] summit, Mt. Washington, N.H." (*Carpenter s.n.* VT). It would be difficult even with modern transportation to be collecting on Mt. Pisgah one day after hiking on Mt. Washington. Why do this and then return to Mt. Washington? Carpenter was camping in the White Mountains a week later; he and Frank Dobbin saw *Geum peckii* on Mt. Washington on 29 July (Dobbin, 1927). Surely Vermont's *G. peckii* voucher is from Mt. Washington, N. H. Incongruous Carpenter labels for specimens of *Scirpus cespitosus* and *Phyllodoce caerulea* are also discussed below.

Luzula spicata

Spiked woodrush, *Luzula spicata* (L.) DC., was first found in New York by Peck in 1898, who described the station (Peck, 1900, p. 645) from the: "top of Wallface Mountain, Essex County . . . It is found in considerable abundance along the brow of the precipice that forms the western wall of Indian Pass." Spiked woodrush is no longer common on the brink of Wallface. In 1989 only 50 plants were found (Zika 10746 NYS), in one tiny area, growing in the thin band of alpine vegetation dominated by *Deschampsia flexuosa* (L.) Trin., *Juncus trifidus* L., *Potentilla tridentata* Soland ex Ait., *Solidago spathulata* spp. *randii* (Porter) Cronq. and *Vaccinium uliginosum*. This population is threatened by trampling when rock climbers are belaying or completing their climb. A second *Luzula* population on gravelly talus directly below suggests a seed rain from the clifftop.

The lower population of *Luzula spicata* is growing in a graminoid-dominated turf among *Agropyron trachycaulon* (Link) Malte, *Agrostis scabra*, *Bromus ciliatus* L., *Carex debilis* Michx., *C. echinata* Murr., *C. houghtonii* Torr., *C. scirpoidea* Michx., and *Poa nemoralis* L. *Luzula spicata* is rare and very local at the cliff base, and is threatened with trampling by rock climbers. The few plants observed in 1989 were along the approach to one of more than 20 technical rock climbs on the ramparts of Wallface (Mellor, 1988).

In Smugglers Notch, Vermont, *Luzula spicata* was recorded between 1879 (*Brainerd s.n.* VT) and 1908 (*Kirk s.n.* NEBC). A small population was re-located (Zika 10903 VT) while exploring with Cathy Paris and David Barrington in 1990, on a steep damp rocky open north-facing turf partially shaded by the steep wall of a gully on the west side of the notch.

Paronychia argyrocoma

Paronychia argyrocoma (Michx.) Nutt. (including var. *albimontana* Fern.), whitlow-wort, was not included in the flora of Vermont (Atwood et al., 1973; Seymour, 1969). Ray Angelo and the late Harry Ahles brought to my attention two Vermont specimens. One sheet has collections from several states, and several labels, one reading: "Willoughby Mt., Stowe Vt., Aug. 1865" (Ex herb. F. J. Bumstead, M. D. s.n. MASS). The site data on this label

are puzzling. There are several plants mounted near the label so it is not clear if the collections came from both Stowe, Lamoille Co. and Willoughby Mountain [Mt. Pisgah], Westmore, Orleans Co. Or perhaps the collections are from only one of the two label sites, and the labeler was confused or in error. The Willoughby area seems more likely. Potential *P. argyrocoma* habitat near Lake Willoughby should be explored, including a granitic cliff with *Potentilla tridentata* Soland. ex Ait. on Wheeler Mountain. This site closely resembles good *Paronychia* habitat on several New Hampshire peaks, including Mt. Willard, Crawford's Notch.

The second Vermont *Paronychia argyrocoma* collection is labeled: "rare, Vermont," with no date (*Ridler 339* BEDF). This label data is typical for a C. E. Ridler collection. His herbarium, with specimens from many states, was described by Huntington (1881) as "extensive." Ridler's vouchers include a number of rare species from cliffs by Lake Willoughby. Ridler (1884) described botanizing the cliffs above Lake Willoughby, but did not mention finding *Paronychia*. If he found the species in the area, it presumably would have been on a return trip after 1884.

There are no recent records for *Paronychia argyrocoma* from Vermont, but more field work in the Lake Willoughby region is needed to determine its current status.

Phleum alpinum

Phleum alpinum L., alpine timothy, reported from "alpine regions, Vermont, F. H. Horsford" (Dole, 1937), is not supported by an herbarium collection. The report is rejected. It is believed to be a confusion with *P. pratense* L., a weed in Vermont's alpine regions.

Phyllodoce caerulea

Vermont's only report of *Phyllodoce caerulea* (L.) Bab., mountain heath (Atwood et al., 1973) rests on a specimen labelled: "Alpine Garden, Mt. Willoughby, 5000-6000 feet, 20 July 1926" (*Carpenter s.n.* VT). Mt. Willoughby is now Mt. Pisgah (2750 feet), a peak with a "flower garden" (Kennedy, 1904). Mt. Washington, N.H. (6288 feet), has an "alpine garden." Dobbin (1927) described finding on Mt. Washington "the mountain heath, *Phyllodoce coerulea* [sic], which we had never before seen." Dobbin

was with Carpenter, and the date was nine days after the apparently mis-dated Vermont collection was made. The altitude data on the "Vermont" specimen also implies it was collected in New Hampshire. As with *Geum peckii*, *P. caerulea* is rejected from the flora of Vermont.

Prenanthes boottii

Prenanthes boottii (DC.) Gray, a rare northeastern endemic, is often thought to be restricted to alpine habitats (e.g., Crow, 1982). On Mt. Mansfield it was found (Zika 4712, 4728 vt) on three schist ledges with an eastern exposure, between 3500 and 3900 feet, well below treeline, growing with *Abies balsamea*, *Asplenium viride* Huds., *Juncus trifidus* L., and *Lycopodium lucidulum* × *selago*. It may be in similar situations on other major peaks.

Peck (1900) discovered Boott's rattlesnake-root on Mt. Marcy in New York in 1898. He noted it was "very rare" but collected at least five plants. It is possible he overcollected and extirpated the population, as there are no subsequent records despite the intensive searches by Adams et al. (1920), DiNunzio (1972, unpubl. M. S. thesis, State Univ. of New York, Syracuse) and many others, including the writer. *P. boottii* is extant on two other Adirondack peaks. Mt. Marcy is in a designated wilderness area, but the summit has been degraded by recreational use this century.

Poa fernaldiana

Poa fernaldiana Nannf., wavy bluegrass, was last seen in Vermont in 1897. A tiny population was re-located in 1990, while botanizing with Everett J. Marshall, on the Nose of Mt. Mansfield. It was associated with *Agrostis mertensii*, *Carex brunnescens*, *Hierochloe alpina* (Sw. ex Willd.), *Lycopodium selago* and mosses, on a steep northeast slope at 3900 feet. Human disturbance in the vicinity dates back to a road and hotel constructed in 1858 at the base of the Nose (3850 feet). Communication facilities were installed on the Nose's summit (4062 feet) in 1954 (Hagerman, 1975). One unintended result was the establishment of weedy populations of *Poa compressa* L. and *P. pratensis* L. They have abrogated some alpine habitat previously available to *P. fernaldiana*, *Hierochloe alpina* and *Carex bigelowii* on the summit of the Nose.

Pyrola minor

Mountain pyrola, *Pyrola minor* L., is inconspicuous and cryptic. Mountain forms of the more common *P. elliptica* Nutt. often produce large mats of the reduced, rotund foliage typical of *P. minor*. At its historical site in Vermont, on the floor of Smugglers Notch near Big Spring (Eggleston, 1895), *P. minor* has not been seen since 1896, despite numerous searches, and is presumed extirpated.

A new Vermont station for *Pyrola minor* (Zika 6211 VT) was located at 3500 feet along the Long Trail on Camels Hump, Huntington, Chittenden Co., growing with *Abies balsamea*, *Chelone glabra* L., *Rubus pubescens* Raf., *Solidago macrophylla* Pursh, *Thalictrum pubescens* Pursh, and *Veratrum viride* Ait. The population consisted of 73 plants in 1982. The colony, along a wet, eroding area on the footpath, is threatened by routine trail work such as ditching and waterbar installation or maintenance.

A historical population in Wilmington Notch, Essex Co., New York, was not re-located after several days of searching in 1989. More field work is required to determine its status there. However, S. J. Smith believed the colony was destroyed by altering the highway alignment in the notch in the 1970's (Alvin Breisch, pers. comm).

Salix herbacea

Salix herbacea L., dwarf willow, was reported from Camels Hump, Vermont by Carpenter (1927), Dole (1937) and Bean et al. (1956). Carpenter's original report was founded on a misidentified sheet of bearberry willow (*S. uva-ursi*) at the Pringle Herbarium (Kirk, 1950). *Salix herbacea* is rejected from the Vermont flora.

Salix planifolia

Tea-leaved willow, *Salix planifolia* Pursh, is an alpine and sub-alpine species in the northeastern United States. Seymour's (1969, 1982) habitat summary: "meadows, swamps" is incorrect for our area, implying low elevation habitats. The statement appears to be based on records from other parts of the species' range, or on misidentified specimens of *Salix discolor* Muhl. from low ele-

vation sites. Four such records are discarded: Vermont collections from Burlington, Fairfax, Stratton and Westford, cited in 1973 by Atwood et al. Vermont's only station for *S. planifolia* is on Mt. Mansfield, and it is extant where Pringle discovered it in 1877.

Scirpus cespitosus

Random extinctions are predicted on functional islands of alpine habitat by island biogeographic theory (MacArthur and Wilson, 1967). This assumption probably explains how deer's hair can be locally dominant in the alpine zone in New Hampshire and New York, yet absent in appropriate habitat in the alpine zones of Mt. Mansfield and Camels Hump. *Scirpus cespitosus* L. is present on the west slope of Mt. Mansfield on sub-alpine ledges at 3000 feet (Zika 724 VT). It is a dominant on the northeast side of Mt. Mansfield, in Smugglers Notch, where it occurs with many of the species found in the Willoughby flora. The current distribution of *S. cespitosus* suggests it may have been present on the summit of Mt. Mansfield, and became locally extinct prior to the first botanical investigations. Examination of macrofossils from the bogs on Mt. Mansfield could answer this question.

Scirpus cespitosus is absent on the sub-alpine cliffs of five peaks around Lake Willoughby in Westmore, Orleans Co., Vermont. A solitary Mt. Pisgah record (Carpenter s.n. VT) from 21 July 1926 appears to be one of several mis-labeled alpine Mt. Washington records (see *Geum peckii* and *Phyllodoce caerulea*), and is dismissed.

Solidago cutleri

Solidago cutleri Fern., alpine goldenrod, is endemic to the mountains of northern New York, Vermont, New Hampshire and Maine. On some ranges it is a common component of the alpine community. In Vermont the population in Smugglers Notch was last documented in 1891. A tiny population was re-located in 1990 on a schist shelf in a ravine on the west side of the notch, at an elevation of 3000 feet. It was growing with *S. spathulata* ssp. *randii*, which is common in the area. The presence of suspected hybrids and the extreme rarity of *S. cutleri* suggests that genetic swamping may be a problem for this population.

The population of alpine goldenrod on the Chin of Mt. Mansfield has not been documented after 1908 (*Flynn s.n.* VT), and is presumed extirpated. It seems unlikely this bright-flowered species could be overlooked during the intensive searches conducted by the author, Bristow et al. (1977) and others. The Chin has been heavily trampled along hiking trails, but is otherwise little changed from the turn of the century. Botanical collecting may have been important in the decline of this population.

Streptopus xoreopolus

Streptopus xoreopolus Fern., mountain twisted stalk, was considered "possibly extirpated" in Maine (Dibble et al., 1989) and was not seen in searches in 1988 (Dibble et al., 1990). A small population was located in 1990 on Hamlin Peak, T3, R9, Piscataquis Co. Five flowering plants were in a snowbank community at the base of an alpine cliff with northeast exposure at 4650 feet elevation, growing with *S. roseus* Michx. and *S. amplexifolius* (L.) DC. The hybrids displayed the strongly clasping leaves and habit of *S. amplexifolius*, combined with the hispid herbage and pink flowers typical in *S. roseus*. Associates included *Cassiope hypnoides*, *Gaultheria hispidula*, *Loiseleuria procumbens* (L.) Desv., *Luzula parviflora*, *Maianthemum canadense*, *Phyllodoce caerulea*, *Poa fernaldiana*, *Rubus pubescens*, and *Vaccinium cespitosum*. To help preserve the colony, no voucher was collected.

Vaccinium cespitosum

Vaccinium cespitosum Michx., dwarf bilberry, is unique among the mountain *Vaccinium* species, with its serrated obovate leaves and solitary axillary flowers. It is probably overlooked because it is low and inconspicuous, and may be more common in river gorges in the northeast than the limited number of current records indicate; Jenkins and Zika (1987) found it on the Missisquoi, Wells and West River drainages in Vermont. The species is scarce but extant at several locations along the ridgeline of Mt. Mansfield, from near the Octagon to the Adams Apple, between 3650 and 4370 feet. In New York a new station was observed along the trail between Lake Tear of the Clouds (4300 feet) and the Panther Gorge shelter (3250 feet), southeast of Mt. Marcy, Keene, Essex Co. Another new population was observed on wet ground

along the trail on the southeast shoulder of Mt. Haystack, Keene, at 3750 feet. About 700 plants were seen on the northeast slope of Mt. Marcy, where it is common between 4800 and 5200 feet in sheltered alpine areas, near treeline, in the general area where Peck (1900) reported it.

Viburnum edule

Squashberry, *Viburnum edule* (Michx.) Raf., often occurs in small populations of 1–6 shrubs in the northern Appalachians. A number of colonies are sure to remain undocumented until there is more off-trail exploration of the headwaters of small mountain brooks, a favored habitat for the species. *Viburnum edule* is extant at four locations on the ridgeline of Mt. Mansfield, Vermont, between 3500 and 3900 feet, growing with *Salix planifolia* and other shrubs (*Zika* 4714, 4715, 4719 vT). The Mansfield population extends into the towns of Cambridge and Stowe, Lamoille Co., as well as into Underhill, Chittenden Co. A new Vermont locality is on the trail to the abandoned fire tower on Mt. Monadnock's east slope, at 3000 feet, in Lemington, Essex Co. (*Zika* 9217 vT). Another new station is on Camels Hump, at 3500 feet in Huntington, Chittenden Co. Nine shrubs were found in wet thickets (*Zika* 6212 vT).

In New York, new locations of small populations were sighted in 1989 on Santanoni Brook (Newcomb), and Algonquin Peak (Keene, *Zika* 10685 NYS). One colony was seen on Phelps Brook (North Elba) in 1981 (*Zika* 5077 vT). Extensive colonies (10–100 shrubs) were seen along the northern Marcy Brook at Indian Falls (Keene, *Zika* 1981 and 1989 observations), on Opalescent River below Uphill Leanto (Keene), on two small brooks draining northeast and southwest of Lake Arnold (Keene), and on the southern Marcy Brook that drains Panther George (Keene). All these sites are in Essex Co., in the Adirondack Mountains.

DISCUSSION

How recently established are these newly reported montane stations? Why were the localities not documented in the herbaria of the numerous, and apparently quite thorough, collectors of the last century? Has there been a recent widespread dispersal of these rare taxa? This last possibility is doubtful. Consider six rare moun-

tain taxa in close proximity in the Adirondacks: *Epilobium horne-mannii* Reichenb., *Festuca brachyphylla*, *Loiseleuria procumbens*, *Luzula spicata*, *Poa fernaldiana*, and *Salix herbacea*. Historically, each is documented from a single site. If they suddenly appeared on a second peak it would suggest recent dispersal, which simply has not happened.

A more likely, though speculative, explanation is that "new" populations of *Prenanthes boottii*, *Agrostis mertensii*, *Empetrum nigrum* etc. are apparently relictual early Holocene populations overlooked or inaccessible to previous botanists. Three Vermont examples, from Mt. Mansfield, Bolton Mtn., and Camels Hump, are given as circumstantial evidence to illustrate the point.

Bear Pond, which is not visible from the alpine ridge, was not mentioned on any of the ca. 1200 herbarium labels I examined for Mt. Mansfield. Bear Pond populations of *Asplenium viride*, *Carex atratifomis*, *Prenanthes boottii*, and *Viburnum edule* were apparently ignored by earlier botanists who collected these species from more accessible areas. Harold St. John (pers. comm.) bush-whacked through formidable krummholz in this area in July 1911 because it was still trailless; he and earlier botanists could easily have missed the ledges with rare species in such difficult terrain. A modern trail now provides access to the vicinity.

Empetrum nigrum and its alpine associates on a Bolton Mountain cliff were discovered in a remote trailless area only when scouting for a new route for the Long Trail in 1982 (Peet, pers. comm.).

On Camels Hump, the dismantling of overnight huts in the hut clearing (3800 feet) and the construction of Gorham Lodge 0.4 miles to the north (3400 feet) was not done until 1950 (Peet, 1977). Thus only recently has there been convenient lodging north of the hut clearing. Naturally the botanical work of the last century focused on the alpine regions south of the hut clearing, and not on the low diversity boreal forest to the north, where a trail was not built until 1910–1911 (Waterman and Waterman, 1989, p. 358). Day hiking trails used by Robbins, Macrae and Tuckerman (Oakes, 1842) were from the east or west, as today. Longer (overnight) hikes from the north apparently were avoided by botanists; e.g., Chisolm (1926) reported a botanical field trip climbing from the east, not the north. "New" sites for *Pyrola minor* and *Viburnum edule* in this paper are on the north trail.

Viburnum edule, and to a lesser degree *Vaccinium cespitosum*,

are the only species studied with substantial numbers of newly reported stations. These sub-alpine (to low elevation) species were largely found in areas accessible to modern botanists due to recently constructed hiking trails and roads. More sites should be found with the off-trail exploration of mountain headwater brooks (*Viburnum edule*) and boating in rapids and river gorges (*Vaccinium cespitosum*).

It is becoming clear that the floras on our alpine peaks are changing; the data show several species declined or became extirpated from alpine areas this century. The reasons for this change are not clear, but several possibilities can be offered. Effects of human disturbance, generally associated with recreation and botanical collecting, may have been detrimental in the past. The Little Ice Age ended in the early 1800's (Dansgaard et al., 1975); Hamburg and Cogbill (1988) noted an average summer temperature increase of more than 2°C at stations in Massachusetts and New Hampshire since 1830. Climatic amelioration following the Little Ice Age could have a negative impact on disjunct species in alpine areas. If so, then current predictions of increased global warming may have serious consequences in the plant communities in northeastern alpine areas. Chronic pollution may also be a potential threat in the future.

Further studies of historical extinctions of alpine species are needed in alpine areas across the northeast (e.g., Dibble et al., 1990). Demographic studies are needed for the apparently declining populations of *Arnica lanceolata*, *Arenaria rubella*, and *Luzula spicata* in order to determine the proximate and ultimate causes of population shifts; all are in remote, protected areas, and the latter two are in essentially pristine habitats. They may be bellwether species for the boreal flora of the northeast.

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